# Restoring non−equilibrium riparian communities in disturbance−altered ecosystems: implications for river management and climate change

**John C Stella**

## Public Comments

No public comments were received for this proposal.

# Technical Synthesis Panel Review

## Proposal Title

#0238: Restoring non−equilibrium riparian communities in disturbance−altered ecosystems: implications for river management and climate change

| Final Panel Rating |
| --- |
| **adequate** |

## Technical Synthesis Panel (Primary) Review

### TSP Primary Reviewer's Evaluation Summary And Rating:

**A well developed and written proposal that addresses critical questions for the Bay Delta rivers: e.g., how do we restore disturbance dependent communities in disturbance altered ecosystems? The proposal is hypothesis driven, uses conceptual models appropriately, and is founded on extensive literature and preliminary data. It is missing, however, a final hypothesis: “cottonwood decline or reduced establishment is not a result of reduced seed source but rather reduced habitat (including appropriate hydrology).” The proposal mentions “biotic interactions” but appears to ignore important role of exotics in cottonwood establishment and sustainability. The population models should include stand structure, fecundity, dispersal, etc. Sampling needs to address interactions of seedling recruitment and flow regimes which would help address the new, suggested hypothesis above. The proposal needs to explain the connections between this work and that already done by Stella.**

### Additional Comments:

**A well developed and written proposal that addresses critical questions for the Bay Delta rivers: e.g., how do we restore**

**disturbance dependent communities in disturbance altered ecosystems? The proposal is hypothesis driven, uses conceptual models appropriately, and is founded on extensive literature and preliminary data. It is missing, however, a final hypothesis: “cottonwood decline or reduced establishment is not a result of reduced seed source but rather reduced habitat (including appropriate hydrology).” The proposal mentions “biotic interactions” but appears to ignore important role of exotics in cottonwood establishment and sustainability. The population models should include stand structure, fecundity, dispersal, etc. Sampling needs to address interactions of seedling recruitment and flow regimes which would help address the new, suggested hypothesis above. The proposal needs to explain the connections between this work and that already done by Stella.**

# Technical Synthesis Panel (Discussion) Review

## TSP Observations, Findings And Recommendations:

**The proposal is well−developed. It is concept model and hypothesis−driven. The research team is well−qualified to conduct this important research. But, the panel and external reviewers identified several important questions that are missing from the proposal. For example, the panel felt the proposal needed to address the following hypothesis: “Cottonwood decline or reduced establishment is not a result of reduced seed source but rather a lack of habitat (particularly recruitment−habitat) including appropriate hydrology.” As all reviewers identified seedling stage recruitment to be as important as looking at adult stages. The proposal also does not sufficiently address the role of exotics. The hypotheses do not address climate change although that linkage is promised as part of the proposal title.**

# Technical Review #1

proposal title: Restoring non−equilibrium riparian communities in disturbance−altered ecosystems: implications for river management and climate change

## Review Form

### Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

| | |
|---|---|
| **Comments** | **This proposal seeks to examine the metapopulation structure, demography, and reproductive ecology of Fremont cottonwood. The objectives and hypotheses are clearly stated and internally consistent.** |
| **Rating** | **excellent** |

### Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

| | |
|---|---|
| **Comments** | **The justification is clearly laid out, and tied back to CALFED Science Program goals. The conceptual model is clearly illustrated in Figure 2. Task 1 is the least supported task. In particular, why is it necessary to 'refine the study design' – isn't this what proposal development is for?** |
| **Rating** | **very good** |

### Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to

generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

| | |
|---|---|
| **Comments** | **This study appears to have multi−party support and to build upon and complement similar projects being conducted on these riparian areas. It involves several disparate aspects (metapopulation structure, demography, reproductive ecology).** |
| **Rating** | **excellent** |

## Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

| | |
|---|---|
| **Comments** | **The project appears to be technically feasible, though I have a number of questions. Task 1: Why is this necessary? Given that the core team has extensive research experience and has used these methodologies in previous studies, why haven't these refinements been incorporated into the proposal? Table 3 lists 7 target streams and reaches, and the proposal seeks to examine 4−6 sites, so why the uncertainty about site selection? Will GIS data be available for a reasonably cost and in a timely manner for the streams and reaches that the core project team doesn't have GIS data for? Task 2: How many patches will be used within each river reach? At what height will cores be taken, and on what proportion of trees? The discussion of excavating stems to root crown doesn't clarify whether this is for all cored trees (ie, all cores taken at root crown) or to develop an allometric equation estimating time to grow to the core height from which other cores were taken? Is there any reason to believe that size−age relationships will be significant or have any explanatory value? In my experience (not with cottonwoods), these relationships have been weak at best. Insufficient information is provided about the demographic analyses – will they be conducted for each patch separately or for each reach? How large will the** |

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| | **sample size for the demographic analysis be? I believe the stand basal area column in Table 4 is incorrect. What are the implications of the age distributions for interannual water flow (e.g., frequency of cohort regeneration)? Task 3: Seed release phenology – how many sites to be measured, and how frequently? The sample area spans about 3.5 degrees of latitude (Table 3) – is there reason to expect this to be enough of a difference to be able to detect biologically significant differences in day length? Fecundity – I didn't follow the discussion about duplicate counts. The verbal formula at the end of the first paragraph on p.12 is incorrect, I believe (needs parentheses to define first term). Task 4: Figure 10 – The caption refers to a high correlation between growth rate and annual flow, but this isn't apparent to me from the figure. I'd like to see a bit more detail about the dendrochronology, since aspen and other Populus spp. cores aren't the easiest to read. Why measure growth rate for a 3–5 year period instead of annually? For example, you could test the correlation between the time series of annual growth rates for each tree and the long–term record of historical flows. Stable isotopes: How will shallow groundwater be sampled? Is there reason to expect the carbon isotope signal within the leaf will change temporally within a season? It seems to me that this would be 'fixed' relatively early in leaf development, so I'd like to see citations supporting the idea that it might change during the season. Will the isotope signal vary with leaf height in the crown?** |
| **Rating** | **good** |

## Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

| | |
|---|---|
| **Comments** | **N/A** |
| **Rating** | |

| | |
|---|---|
| | excellent |

## Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

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| Comments | The products of this study will be useful to the resource community. Knowledge of cottonwood reproductive ecology would enable water flow managers to make more informed decisions. No attention is given to making data accessible to the public, although results will be presented and published in peer−reviewed publications. |
| Rating | very good |

## Additional Comments

| | |
|---|---|
| Comments | N/A |

## Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

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|---|---|
| Comments | The team appears well−qualified to conduct this work. CVs were excessive (too many pages). |
| Rating | excellent |

## Budget

Is the budget reasonable and adequate for the work proposed?

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| Comments | I appreciated the detail in the budget. Task 1: As mentioned above, I question the necessity of this task |

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| | **– is 10% of the proposal budget really required to revise the study plan that approval is being sought by CALFED? Do peer reviews (not clear if these are friendly or anonymous) of final study plans really justify $1000 honoraria? I see funding for undergraduate technicians and for a post−doctoral associate, but not for graduate students. This seems to be the type of project that would be conducive to graduate support.** |
| **Rating** | **very good** |

## Overall

Provide a brief explanation of your summary rating.

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| **Comments** | **Overall, this is a well−developed and well−written proposal. The results of this research would be timely and valuable for our understanding of how to manage and restore Fremont cottonwood riparian ecosystems.** |
| **Rating** | **very good** |

# Technical Review #2

proposal title: Restoring non−equilibrium riparian communities in disturbance−altered ecosystems: implications for river management and climate change

## Review Form

### Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

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| **Comments** | **The overarching goal of this research is clearly stated in the proposal: How do we restore disturbance−dependent comunities in disturbance−altered ecosystems? The idea is timely and important, since most riparian ecosystems in California have been significantly altered by land conversion and altered flow regimes. The problem is an interesting one, focusing on specific dynamics of an early successional riparian species, Fremont Cottonwood. A secondary stated goal of this project is to develop models that can be used to optimize water use to ensure that human needs are met and that riparian ecosystems remain viable.** |
| **Rating** | **excellent** |

### Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

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| **Comments** | **The proposal authors and others have assembled a body of knowledge on various aspects of riparian ecosystem and cottonwood population dynamics. Interestingly, they do not cite the recent volume on California Riparian Systems (Riparian Joint Habitat Venture,** |

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| | **2003), which seems like an obvious piece of work to cite. The conceptual model put forward in Fig. 2 clearly describes the links between broad scale drivers and ecological patterns and processes. The proposal states that the PIs will study those patterns and processes in the shaded box--however there is very little focus on biotic interactions, which may be critical (see comments below in "Approach" section).** |
| **Rating** | **good** |

## Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

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|---|---|
| **Comments** | **This is a complex problem that requires a multi-scale, interdisciplinary approach. The PIs have developed a proposal that will address a number of the critical aspects of cottonwood population dynamics, using a set of innovative measurements (such as the stable isotope work). There is a strong and relevant emphasis on understanding the mechanisms of cottonwood survival and reproduction. Linking these mechanistic studies to broader scale patterns is a real strength of the proposal. A few key aspects seem to be missing, however. First, there is no mention of how exotic species may interact with Fremont cottonwood to influence its establishment, and ultimately the composition of riparian communities. Tamarisk is a huge issue in many California watersheds, where it appears to compete significantly with cottonwood for water, especially during drought periods. Because this proposal focuses explicitly on water use and the sources of water during different periods of the year, there is a terrific opportunity to examine how water use of these two species differs and how that may affect cottonwood establishment, survival, and population dynamics. There is no mention of tamarisk** |

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| | **or any other exotic species in the proposal, however, so the component of the conceptual model labeled "biotic interactions" appears to be ignored in the proposal. This is a serious omission. Secondly, the PIs couch their study in terms of understanding "metapopulation dynamics" of Fremont cottonwood, a key riparian species. However, there is no mention of why they chose this particular conceptual framework (metapopulation theory), how this framework guides their understanding of this system, and how their measurements will measure aspects of metapopulation dynamics, which must include some understanding of the links between local and regional population dynamics. There is a missed opportunity here as well to project cottonwood population dynamics using population modeling. Measurements of stand age structure, fecundity, dispersal, survival, etc. could be incorporated into population viability models to project future population sizes under various climate change scenarios. This would add a lot to the analyses and the conclusions. Third, the proposal text states that the project "...will explicitly assess the impacts of current water operations on population processes and trends..." With the given sampling scheme, however, it is difficult to ascertain how the effects of different water operations will be disentangled from, say, the effects of latitude. The sampling scheme is stratified by latitude, but not by type of water operation or flow rate. Thus, it is not clear how conclusions will be drawn about the links between current water operations and population processes. Finally, there is little mention of seedling survival. If this has already been studied, then relevant references should be included. If it hasn't, then this seems to be an important aspect to include in the proposal.** |
| **Rating** | **fair** |

## Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

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| **Comments** | **The approach has some limitations, discussed above in the "Approach" section. The methods presented appear to be technically feasible and the authors have experience with them. The technique of linking degree−day models with timing of seed release and probablility of adult survival appears to be particularly promising.** |
| **Rating** | **good** |

## Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

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| **Comments** | **There is no explicit monitoring described in the proposal. The project includes collection of broad−scale data and fine−scale mechanistic studies.** |
| **Rating** | **not applicable** |

## Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

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| **Comments** | **The products of the proposal as written would be interesting, but limited in their scope. I think that the work would benefit by the additions described above in the "Approach" section, and these additions would facilitate the use of the project's products in** |

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| | **restoration and conservation efforts throughout the Central Valley.** |
| **Rating** | **good** |

## Additional Comments

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| **Comments** | **This proposal addresses an important, complex, and timely issue, but could be enhanced by addressing the issues raised above.** |

## Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

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| **Comments** | **The PIs have a good track record of completing and publishing research findings. Their expertise is complementary and appropriate for the proposed work. They have the available infrastructure (dendro lab, isotope lab) to complete the research. They have access to relevant aerial photos and GIS data layers on riparian vegetation in particular drainages.** |
| **Rating** | **very good** |

## Budget

Is the budget reasonable and adequate for the work proposed?

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| **Comments** | **The budget seems a bit excessive for the amount of information that will be gained from this research.** |
| **Rating** | **fair** |

## Overall

Provide a brief explanation of your summary rating.

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| **Comments** | **This proposal addresses a critical issue in California ecology and management; the dynamics of riparian ecosystems. The PIs have chosen to focus on a key species in the system, and propose to combine broad− and fine−scale studies to understand population dynamics and persistence. The proposal is "good" for those reasons, but does not rate as "very good" or "excellent" because of the several limitations noted above in the "Approach" section.** |
| **Rating** | **good** |

# Technical Review #3

proposal title: Restoring non−equilibrium riparian communities in disturbance−altered ecosystems: implications for river management and climate change

## Review Form

### Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

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| **Comments** | **The hypotheses are listed very clearly but in my view the importance of modified flow regime is a factor of overriding importance that is not well−addressed. Although there is a focus on metapopulation dynamics (that relate in large part to flood events) there are really not explicit hypotheses that deal with spatial variation in patch structure relating to the disturbance regime of flood events. Although flow regime is repeatedly mentioned in the proposal as an important factor in cottonwood population dynamics, it is not addressed well in the research plan. I think that there is general agreement that a major factor limiting cottonwood regeneration is the lack of sufficient habitat for seedling establishment and regeneration; as such the focus of this proposal primarily on adults seems misdirected.** |
| **Rating** | **good** |

### Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

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| **Comments** | **As noted above, existing knowledge on cottonwood recruitment has revealed the overwhelming importance of lack of seedling recruitment habitat (due to restricted flows) as a factor reducing cottonwood regeneration. By focusing primarily on adults, this proposal does not clearly address this. As noted by the authors as well as other researchers, seed limitations are not the problem, seedling recruitment sites are. Further, this proposal does not communicate very cogently how this research will build upon a model that was developed by a prior CALFED grant to one of the PIs. From the information provided, there seems to be a large overlap between what this proposal states that it wants to do and what supposedly has been accomplished by the prior CALFED grant to PI Stella.** |
| **Rating** | **fair** |

## Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

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| **Comments** | **The methods are relatively straightforward and standard techniques (esp. the dendrochronology approaches). However, except for some aspects of the preliminary metapopulation survey, the methods do not address the primary limitation to cottonwood regeneration (i.e. mechanisms and factors limiting seedling recruitment). Again, it is unclear as to how much of the recruitment research has already been completed by the prior CALFED support to Stella. The use of latitude as a proxy for climate does not mean that this is a good proxy for modifications in flow rate. The techniques are not that novel and are primarily descriptive as** |

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| | **opposed to experimental. It is not clear that we will learn anything about the factors affecting adult cottonwoods that we don't already know from other studies (in particular work already completed by one of the PIs i.e. Stella). This is especially true for ecophysiology work. One aspect of the WUE study deserves comment. The authors try to argue that carbon isotope discrimination will be related to WUE; this is only valid if VPDs are constant across treatments. This would seem to be unlikely between mesic and xeric sites and the authors need to address this problem.** |
| **Rating** | **fair** |

## Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

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| **Comments** | **Because the techniques are fairly standard and the authors have experience in these approaches, there should not be any significant problems in executing the studies as proposed. The linkage of the proposed work and the previous CALFED supported study to Stella to develop a field calibrated model of riparian tree recruitment is very fuzzy, especially given that this model would appear to focus on the main hypotheses of the current proposal.** |
| **Rating** | **good** |

## Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

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|---|---|
| **Comments** | |

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| | **In my opinion, because the study is relatively short term and there are no experimental manipulations proposed, I do not think that monitoring is a significant aspect of this proposal.** |
| **Rating** | **not applicable** |

## Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

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|---|---|
| **Comments** | **I am not convinced that focusing on adult demography and ecophysiology will really help to develop management guidelines for increasing cottonwood populations in California. A focus on the levels and patterns of flow required to generated seedling recruitment would seem to be much more relevant to management applications. Further, I do not see the basic research findings from the ecophysiology studies to be that novel; I think that they are publishable but most of the research has been done before (a lot of it by one of the PIs).** |
| **Rating** | **fair** |

## Additional Comments

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| **Comments** |

## Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

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| **Comments** | **In general this is a very capable team and some of the members have a great deal of experience in this** |

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| | **system. Although Battles has an excellent research track record in conifer systems, he does not have any real experience in riparian systems which might be a problem. On the other hand Stella, in particular, has completed a large amount of work in this riparian system.** |
| **Rating** | **very good** |

## Budget

Is the budget reasonable and adequate for the work proposed?

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|---|---|
| **Comments** | **Although some of the salary allocations seemed rather formulaic (esp. for Battles and Stella) in that every task seemed to require the same number of hours, the overall budget seems reasonable. Some of the charges from the Stillwater consulting firm seemed a bit high but I admit that I'm not sure what the standard going rates are for these kinds of consulting services.** |
| **Rating** | **very good** |

## Overall

Provide a brief explanation of your summary rating.

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| **Comments** | **My overall evaluation is based primarily on three aspects. First, I think that a lack of focus on the interaction between flow regime and seedling recruitment really reduces the usefulness of this research to address the primary factors limiting cottonwood populations along California rivers. Second, the proposal has not clearly described how the studies proposed link to, and build upon the large amount of CALFED−supported work already completed by Stella. It looks like there is huge overlap between this already completed work and the proposed work described here. The authors need to convince the reader that the additional studies proposed really** |

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| | **represent something different and an important addition to the work already completed. Finally, I think that the ecophysiology studies are not that different from several studies already completed (some by the PI Stella) and so I'm not convinced that they will provide any substantially new information.** |
| **Rating** | **good** |